eXpeRAID

Command Line Interface

User Guide

Nov 05, 2007

Version: 1.0

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Revision History

Rev – A 11-JUN -2007	JeffChang	1. Initial Draft.
Rev – B 10-AUG -2007	ShoneCheng	2. Removed unnecessary commands and modified command names to match GUI's.
Rev – C 14-AUG -2007	ShoneCheng	3. Modified some command names and parameters of command 'SetLunMap', 'CreateShot' and 'MigrateArray', added Appendix I for Migration command reference. Added 'CancelSplitSchedule' command.
Rev – D 03-SEP -2007	ShoneCheng	4. Removed parameter "Array" for CreateArray command. Added DumpMiscInfo and DumpDriveInfo commands. Modified the description of DumpCtrlEvent command.
Rev – E 19-OCT -2007	ShoneCheng	5. Removed CLI command "BatteryState". Added Chapter 1 "Introduction" and Chapter 2 "Using CLI", the original Chapter 1 had been moved to Chapter 3.
Rev – F 02-NOV -2007	ShoneCheng	6. Modified the description in section 2.1 Pre-action.
Rev – G 05-NOV -2007	ShoneCheng	7. Official release version 1.0.

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1. Introduction

This user guide provides eXpeRAID Command Line Interface (CLI) instructions for configuring and maintaining your eXpeRAID. Before using this CLI, we assume that you have already installed your controller in your system. If you have not yet installed eXpeRAID, see Accusys eXpeRAID Installation User manual for instructions.

1.1 Overview

This Command Line Interface (CLI) is provided for you to configure and manage the Accusys eXpeRAID components in Linux, Mac or Windows. The CLI is useful under environments where a graphical user interface (GUI) is not available. Through CLI, you can perform most of the storage management tasks that you perform with the eXpeRAID storage manager GUI. CLI commands can be executed under either interactive or non-interactive (script) mode, providing higher level API functionalities.

1.2 Supported Operating Systems

- Windows: XP, 20xx, Vista, …, etc.
- Linux: Fedora Code, SuSE, Debian, …, etc.
- Mac: Mac Pro, G5 …, etc.

CLI supports both 32-bit and 64-bit versions. Be sure you are using the correct version.

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2. Using CLI

2.1 Pre-action

Before using CLI, make sure the controller(s) has been connected to the host and the driver(s) of the controller(s) has been installed on the OS properly.

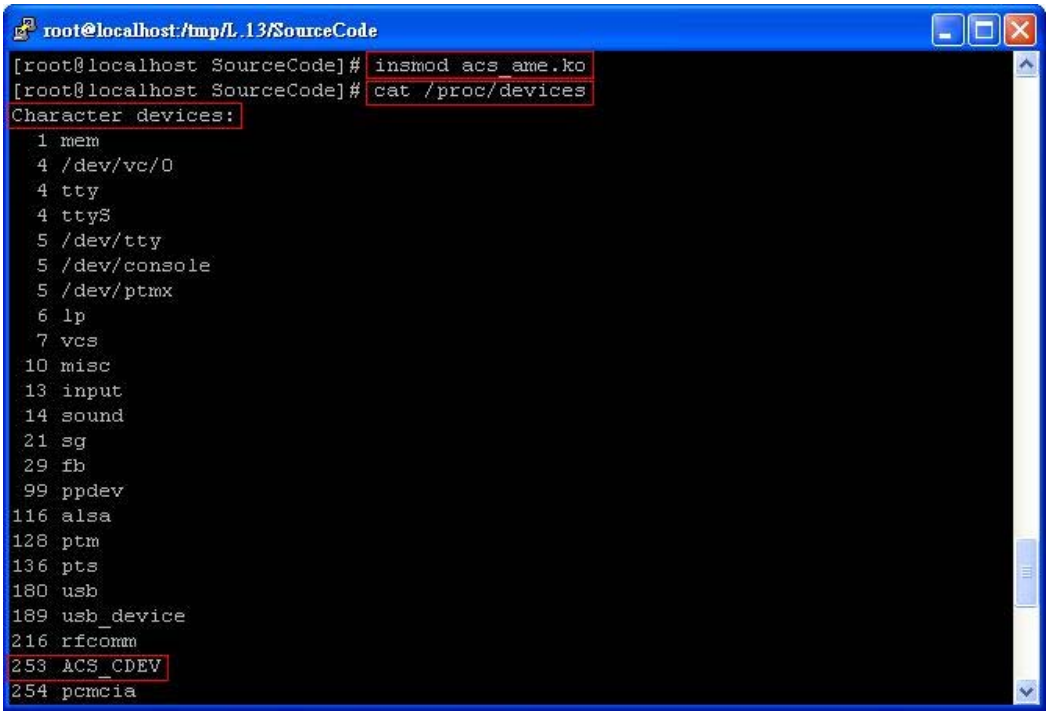
Under Linux, you may need to execute the following command to let CLI find the controller normally: mknod /dev/ACS_CDEVi c NUM i

where number NUM is determined by referencing the Character devices listed in /proc/devices in which the string ACS_CDEV is located. The number i should be 0 when only one controller is found. If other controllers are found, use 1, 2.. for i to make node of each controller one by one.

Anyway, the necessity of this procedure depends on how the driver is installed.

Example for Linux special case:

1. Type: insmod acs_ame.ko [Enter] under the folder where the driver "acs_ame.ko" is located.
2. Type: cat /proc/devices [Enter], a list of Character devices will appear, in which the device number of ACS_CDEV is 253(The value alters through different systems.)



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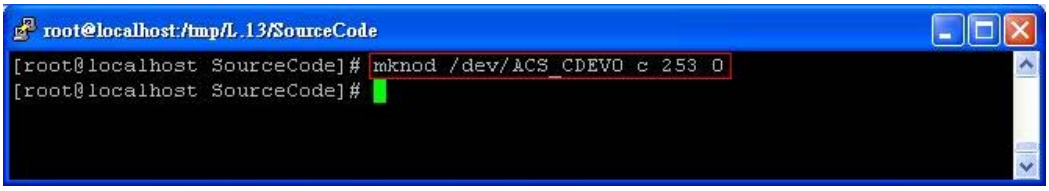
3. Type: mknod /dev/ACS_CDEV0 c 253 0 [Enter], a device file "ACS_CDEV0" will be created and CLI will be able to find the controller through this device file.



2.2 Execution Mode

There are two methods to run CLI commands - interactive mode and non-interactive mode. For each mode, all commands and parameters must follow the CLI command format to be executed normally.

2.2.1 Interactive Mode

To trigger CLI interactive mode, simply run the CLI execution file under the command line of the OS. If the controller has been found, a password verification prompt for the default controller will appear. After inputting the correct password, the CLI prompt "CLI>" will appear. All CLI commands can be executed under this prompt.

2.2.2 Non-interactive Mode

There are two types of non-interactive mode for CLI. One calls the CLI command "RunScript" to execute pre-written script files which contain bunches of CLI commands. The other one calls CLI commands by adding them as the parameter of the CLI execution file individually.

The scripts of both types of non-interactive mode are written based on the following format:
acs_cli <CLI command> [Parameters of the CLI command]
which can be executed as a single command under the command line of the OS.

2.2.2.1 CLI script Mode

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This non-interactive mode is implemented by calling the CLI command "RunScript".
For example:
In Sample1.sh(Included in the folder where CLI application is located) under Linux, it contains the following commands:
./acs_cli RunScript acs_sample1.script
./acs_cli RunScript acs_sample2.script
Both acs_sample1.script and acs_sample2.script contain a bunch of CLI commands.

2.2.2.2 Shell script Mode

This mode is implemented by executing all CLI commands following the format:
acs_cli <CLI command> [Parameters of the CLI command]
For example:
In Sample2.sh under Linux, it contains commands like
./acs_cli CtrlIndex 0
./acs_cli CheckPassword 00000000
…
The first line sets the controller index to 0 and the second line verifies the password of the controller with index 0.

To complete both Sample1.sh and Sample2.sh successfully, the active controller must have 4 Spare drives(On slot 1~4) connected. For both scripts, all 4 drives will be restored to Spare after completing the script successfully.

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3. CLI Command Line Configuration

3.1 CLI Command Format

Command Name	**Command Description**
Command	
Parameter 1	**Parameter Description**
[Format 1]	
Parameter 2	
[Format 2]	
Parameter 3	
…	
Parameter n	
[Format n]	**Example**

Command Format field description:

Command Name: CLI Command Name.

Parameter 1 ~ n: CLI Command Parameters.

Command Description: Describe CLI Commands in brief.

Parameter Description: Describe Parameters in detail.

Example: Gives an example for the command.

Command Syntax:

<Command Name> [Format 1] …[Format n]

Format Conventions:

<text> indicates items that user must specify.

[text] The text item within brackets is optional.

< :> indicates the 'or' condition. For which user has a choice for the options listed within, and only one can be specified.

<~> indicates the value range. For which user has a choice for the values within the range, and only one can be specified.

<,> indicates a separation between integer values.

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3.2 CLI Reply Status

- **InBand(Controller) command success.**
- **InBand command failed.**
  CLI will display "Reason: <Error reason description>".
- **Invalid command:** CLI receives unrecognized commands.
- **Invalid parameter "Param":** CLI receives incorrect parameter of the input command.
  CLI will display the command usage when this error occurs under the interactive mode.
- **Syntax error:** Parameter(s) of the input command doesn't match the command syntax.
  CLI will also display the command usage under the interactive mode.
- **Other errors:** <Specific error description>.

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3.3 CLI Command Set

3.3.1 Basic CLI Commands

3.3.1.1

Command Name	Command Description
Main	Use this command to show the main information page, which lists all available CLI commands with brief descriptions.
	Parameter Description
	N/A

3.3.1.2

Command Name	Command Description
CtrlIndex	Use this command to set a specified controller to be active. The default controller will be set to controller 0 if it exists.
Parameter 1	**Parameter Description**
Controller index: <0~n>	Controller index: <0~n>, where n stands for the maximum index number of the available controller(s).

3.3.1.3

Command Name	Command Description
CheckPassword	Use this command to verify password of the active controller. The controller commands can only be issued after the password being verified.
Parameter 1	**Parameter Description**
Password: <CHARS>	Password: CHARS must be an 8-character alphabetic string.
	Example
	CLI>CheckPassword 00000000 [Enter] If 00000000 is a correct password for the active controller, then CLI will return success and the controller can receive commands normally after that.

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3.3.1.4

Command Name	**Command Description**
SetPassword	Use this command to set password of the active controller.
Parameter 1	**Parameter Description**
Password: <CHARS>	Password: CHARS must be an 8-character alphabetic string.

3.3.1.5

Command Name	**Command Description**
CtrlName	Use this command to set controller name of the active controller.
Parameter 1	**Parameter Description**
Controller Name: <CHARS>	Controller Name: CHARS may not exceed 16 characters.
	Example
	CLI>CtrlName Ctrl1 [Enter] The controller name will be set to 'Ctrl1'. If the number of characters in parameter 1 is more than 16, the additional characters will be ignored.

3.3.1.6

Command Name	**Command Description**
RunScript	Use this command to run CLI commands from a pre-written script file.
Parameter 1	**Parameter Description**
File Path: <[DIR] <FileName>>	File Path: Specify an existing script file(FileName) located in the specified directory.
	Example(Under Linux environment)
	CLI> RunScript /tmp/script1 [Enter] CLI will start to run commands written in the script file 'script1'

3.3.1.7

Command Name	**Command Description**
Exit	Use this command to quit CLI command line interface.
	Parameter Description
	N/A

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3.3.2 Information Display Commands

3.3.2.1

Command Name	Command Description
DumpArrayInfo	Use this command to display information of the specified array.
Parameter 1	**Parameter Description**
Array No.: <1~4>	Array No.: Specified array number from 1 ~ 4 for information display.
	Example
	CLI>DumpArrayInfo 1 [Enter] CLI will display the information of Array 1 if it exists.

3.3.2.2

Command Name	Command Description
DumpSliceInfo	Use this command to display slice information of the specified array.
Parameter 1	**Parameter Description**
Array No.: <1~4>	Array No.: Specified array number from 1 ~ 4 to display slice information.

3.3.2.3

Command Name	Command Description
DumpJBODInfo	Use this command to display JBOD information of the active controller.
	Parameter Description
	N/A

3.3.2.4

Command Name	Command Description
DumpCtrlEvent	Use this command to display event(s) of the active controller. CLI will display up to 32 latest events(if any) each time when this command has been issued.
	Parameter Description
	N/A

3.3.2.5

Command Name	Command Description
DumpCtrlInfo	Use this command to display controller information of the active controller.
	Parameter Description
	N/A

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3.3.2.6

Command Name	Command Description
DumpLockDriveInfo	Use this command to display information of all locked drives.
	Parameter Description
	N/A

3.3.2.7

Command Name	Command Description
DumpSnapShotInfo	Use this command to display information of all existing mirror snapshots.
	Parameter Description
	N/A

3.3.2.8

Command Name	Command Description
DumpMiscInfo	Use this command to display information of miscellaneous settings.
	Parameter Description
	N/A

3.3.2.9

Command Name	Command Description
DumpDriveInfo	Use this command to display information of all drives.
	Parameter Description
	N/A

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3.3.3 Basic Array Configuration Commands

3.3.3.1

Command Name	**Command Description**
CreateArray	Use this command to create an array with specified RAID level.
Parameter 1	**Parameter Description**
RAID Level: <Level=<R0:R1:R5:R6:R01>>	RAID Level: R0: RAID Level 0 R1: RAID Level 1 R5: RAID Level 5 R6: RAID Level 6 R01: RAID Level 0+1
Parameter 2	
Stripe Size: <Stripe=<8:16:32:64:128:256>>	Stripe Size: Measures in KB. 1 KB=2 Blocks.
Parameter 3	
Initialization Type: <Type=<Fly:Evaluation>>	Initialization Type: Fly: On-the-fly initialization Evaluation: Performance evaluation
Parameter 4	
Member Drives: <Drive=<z1,x~y,z2>>	Member Drives: Drive=<z1,x~y,z2> where z1, z2, x and y stand for drive numbers and y must be larger then x.
	Example
	CLI>CreateArray Level=R5 Stripe=128 Type=Fly Drive=3,4,6~8 [Enter] Array will be created with drive 3,4,6,7,8 with an unused array number if all specified drives are available. If all array numbers have been used CLI will reply error.

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3.3.3.2

Command Name	Command Description
DeleteArray	Use this command to delete a specified array.
Parameter 1	**Parameter Description**
Array No.: <1~4>	Array No.: Specify an array number to be deleted.
	Example
	CLI>DeleteArray 1 [Enter] Array 1 will be deleted if it exists and is not in use.

3.3.3.3

Command Name	Command Description
CreateJBOD	Use this command to create JBOD with the specified drive number.
Parameter 1	**Parameter Description**
Drive No.: <1~n>	Drive No.: <1~n>, where n stands for maximum available drive number.

3.3.3.4

Command Name	Command Description
DeleteJBOD	Use this command to delete an existing JBOD.
Parameter 1	**Parameter Description**
JBOD No.: <1~n>	JBOD No.: <1~n>, where n stands for maximum JBOD number.

3.3.3.5

Command Name	Command Description
SetSlice	Use this command to set a slice for the specified array.
Parameter 1	**Parameter Description**
Array No.: <Array=<1~4>>	Array No.: Specify an array number to set slice.
Parameter 2	
Slice Number: <Slice=<0~15>>	Slice Number: Specify the slice number to be created.
Parameter 3	
Slice size: <Size=xxx>>	Slice size: Measures in GBytes. Set "Size=0" to delete a slice.
	Example
	CLI>SetSlice Array=1 Slice=0 Size=120 [Enter] Slice 0 will be set to 120GB if Array 1 exists and the free capacity of Array 1 is large enough(>120GB).

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3.3.3.6

Command Name	**Command Description**
SetLunMap	Use this command to set a Lun Map for an existing slice or JBOD.
Parameter 1	**Parameter Description**
LUN No.: <Lun=<0~63>>	LUN No.: Specify the Lun number to be mapped.
Parameter 2	
Array No.: <Array=<1~4>: JBOD= <1~n>>	Array No.: Array =1~4, Maps Lun to a specified Array JBOD=1~n, Maps Lun to a specified JBOD
Parameter 3	Slice No.:
Slice No.: <Slice= <0~15>>	This parameter is not needed when parameter 2 uses JBOD.
	Example
	CLI>SetLunMap Lun=0 JBOD=1 [Enter] Lun 0 will be mapped to JBOD1 if it exists.
	CLI>SetLunMap Lun=0 Array=1 Slice=0 [Enter] Lun 0 will be mapped to slice 0 of array 1 if it exists.

3.3.3.7

Command Name	**Command Description**
DeleteLunMap	Use this command to delete an existing Lun Map.
Parameter 1	**Parameter Description**
LUN No.: <0~63>	Lun No.: Specify the Lun number to be unmapped.

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3.3.4 Advanced Array Configuration Commands

3.3.4.1

Command Name	**Command Description**
ExpandArray	Use this command to expand an array with specified drive count.
Parameter 1	**Parameter Description**
Array No.: <Array=<1~4>>	Array No.: Specify an array number to be expanded.
Parameter 2	
Drive Count: <DriveCnt=<1~n>>	Drive Count: Specify how many drives will be expanded to the array. Drive Count must not be larger then the number of spare drives.
	Example
	CLI>ExpandArray Array=1 DriveCnt=3 [Enter] Array 1 will be expanded with 3 drives if Array 1 exists and the spare drive quantity are more then or equal to 3.

3.3.4.2

Command Name	**Command Description**
MigrateArray	Use this command to migrate an array from the original RAID level to a specified RAID level.
Parameter 1	**Parameter Description**
Array No.: <Array=<1~4>>	Array No.: Specify an array number to be migrated.
Parameter 2	
Target RAID Level: <TargetLevel=<R0:R1:R5:R6:R01>>	Target RAID Level: Specify the target RAID level for the specified array to be migrated to.
Parameter 3	Drive Count: Specify the total drive count which the target RAID level would have. Please refer to the Array Migration Matrix listed in **Appendix I** to check the migration legality.
Drive Count: <DriveCnt=xxx>	
	Example
	CLI>MigrateArray Array=1 TargetLevel=R5 DriveCnt=4 [Enter] Array 1 will be migrated from the original RAID level to RAID level 5 which has a total member drive count of 4 if Array 1 exists and all parameters follow the rule of the Array Migration Matrix.

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3.3.4.3

Command Name	**Command Description**
RebuildParity	Use this command to rebuild parity of an array which contains parity. i.e. RAID 5 or RAID 6.
Parameter 1	**Parameter Description**
Array No.: <Array=<1~4>>	Array No.: Specify an array number to rebuild parity.
Parameter 2	
State setting: <State=<Start:Stop>>	Status setting: Start or stop the parity rebuilding of the specified array.
	Example
	CLI>RebuildParity Array=1 State=Start [Enter] Array 1 will start to rebuild parity if it exists and is configured as RAID 5 or RAID 6.

3.3.4.4

Command Name	**Command Description**
VerifyParity	Use this command to verify parity of an array which contains parity. i.e. RAID 5 or RAID 6
Parameter 1	**Parameter Description**
Array No.: <Array=<1~4>>	Array No.: Specify an array number to verify parity.
Parameter 2	
State setting: <State=<Start:Stop>>	Status setting: Start or stop the parity verification of the specified array.

3.3.4.5

Command Name	**Command Description**
RefreshArray	Use this command to refresh data of the specified array.
Parameter 1	**Parameter Description**
Array No.: <Array=<1~4>>	Array No.: Specify an array number to be refreshed.
Parameter 2	
State setting: <State=<Start:Stop:Pause>>	State setting: Start, stop the array refreshment or just pause the refreshment and restart it with 'State=Start' parameter any time after it has been paused.
	Example
	CLI>RefreshArray Array=1 State=Start[Enter] Array 1 will start to refresh data if it exists.

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3.3.4.6

Command Name	Command Description
RefreshPriority	Use this command to set the priority of array refreshment. **This setting would be applied to all arrays which are being refreshed.**
Parameter 1	**Parameter Description**
<High:Medium:Low>	Select the priority for array refreshment function.

3.3.4.7

Command Name	Command Description
UnlockDrive	Use this command to unlock a locked drive.
Parameter 1	**Parameter Description**
Drive No.: <1~n>	Drive No.: <1~n>, where n stands for the maximum locked drive number.

3.3.5 Mirror Snapshot Configuration Commands

3.3.5.1

Command Name	Command Description
CreateShot	Use this command to create a mirror snapshot.
Parameter 1	**Parameter Description**
Shot No.: <Shot=<1~8>>	Shot No.: Specify the mirror snapshot number to be created.
Parameter 2	
Source Array No.: <SourceArray=<1~4>: SourceJBOD=<1~n>>	Source Array No.: SourceArray =1~4, uses an array as the source shot. SourceJBOD=1~n, uses JBOD as the source shot.
Parameter 3	
Source Slice No.: <SourceSlice= <0~15>>	Backup Array No.: BackupArray =1~4, uses an array as the backup shot. BackupJBOD=1~n, uses JBOD as the backup shot.
Parameter 4	
Backup Array No.: <BackupArray =<1~4>: BackupJBOD=<1~n>>	Slice No.: This parameter is not needed when parameter 2 or parameter 4 uses JBOD.
Parameter 5	
Backup Slice No.: <BackupSlice= <0~15>>	**Example**
	CLI>CreateShot Shot=1 SourceArray=1 SourceSlice=0 BackupJBOD =1 [Enter] Shot 1 will be created and data in slice 0 of Array 1 will start to backup to JBOD1 if all parameters meet legal conditions.

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3.3.5.2

Command Name	Command Description
DeleteShot	Use this command to delete a mirror snapshot.
Parameter 1	**Parameter Description**
Shot No.: <1~8>	Shot No.: Specify an existing mirror snapshot to be deleted.

3.3.5.3

Command Name	Command Description
ResyncShot	Use this command to resynchronize a mirror snapshot.
Parameter 1	**Parameter Description**
Shot No.: <1~8>	Shot No.: Specify an existing mirror snapshot to be resynchronized.

3.3.5.4

Command Name	Command Description
SplitShot	Use this command to split a mirror snapshot.
Parameter 1	**Parameter Description**
Shot No.: <1~8>	Shot No.: Specify an existing mirror snapshot to be split.

3.3.5.5

Command Name	Command Description
SplitSchedule	Use this command to schedule the split time of the specified mirror snapshot.
Parameter 1	**Parameter Description**
Shot No.: <Shot=<1~8>>	Shot No.: Specify an existing mirror snapshot to assign split schedule.
Parameter 2	
Year: <Year=<0~99>>	Year: Year=xx means Year 20xx.
Parameter 3	**Example**
Month: <Month=<1~12>>	**CLI>SplitScheduling Shot=1 Year=07 Month=12 Day=15 Hour=0 Min=0 [Enter]** Shot 1 will start to split at 2007/12/15 0:0 if shot 1 exists and has not been split yet.
Parameter 4	
Day: <Day=<1~31>>	
Parameter 6	
Hour: <Hour=<0~23>>	
Parameter 7	
Minute: <Min=<0~59>>	

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3.3.5.6

Command Name	Command Description
CancelSplitSchedule	Use this command to cancel split schedule for the specified mirror snapshot.
Parameter 1	**Parameter Description**
Shot No.: <1~8>	Shot No.: Specify an existing mirror snapshot to cancel schedule.

3.3.6 Miscellaneous Commands

3.3.6.1

Command Name	Command Description
DiskLagProof	Use this command to enable or disable Disk Lag Proof mode. This mode is only effective on RAID Level 5.
Parameter 1	**Parameter Description**
<Enable:Disable>	Enable / Disable Disk Lag Proof mode.

3.3.6.2

Command Name	Command Description
NCQMode	Use this command to enable or disable NCQ(native command queue) mode.
Parameter 1	**Parameter Description**
<Enable:Disable>	Enable / Disable NCQ mode.

3.3.6.3

Command Name	Command Description
SMARTMode	Use this command to enable or disable SMART pre-failure warning mode.
Parameter 1	**Parameter Description**
<Enable:Disable>	Enable / Disable SMART pre-failure warning mode.

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3.3.6.4

Command Name	Command Description
SMARTPollingPeriod	Use this command to set the polling frequency of SMART pre-failure warning mode.
Parameter 1	**Parameter Description**
Polling Time: <1Min:15Min:30Min: 60Min:2Hr:4Hr:8Hr>	Polling Time: Set Polling Time as the SMART polling period.

3.3.6.5

Command Name	Command Description
BeeperMode	Use this command to enable or disable the controller beeper.
Parameter 1	**Parameter Description**
<Enable:Disable>	Enable/Disable controller beeper.

3.3.6.6

Command Name	Command Description
EQMode	Use this command to enable or disable Equalization Mode.
Parameter 1	**Parameter Description**
<Enable:Disable>	Enable / Disable Equalization Mode.

3.3.6.7

Command Name	Command Description
CtrlCache	Use this command to enable or disable controller cache.
Parameter 1	**Parameter Description**
<Enable:Disable>	Enable/Disable controller cache.

3.3.6.8

Command Name	Command Description
SyncCacheMode	Use this command to enable or disable Synchronize Cache mode.
Parameter 1	**Parameter Description**
<Enable:Disable>	Enable/Disable Synchronize Cache mode.

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3.3.6.9

Command Name	Command Description
PrefetchNumber	Use this command to assign the maximum pre-fetch number.
Parameter 1	**Parameter Description**
Pre-fetch Number: <1:2:4:8:16:32:64:128>	Pre-fetch Number: The basic unit of maximum pre-fetch number is one stripe. For example, if the maximum pre-fetch number is 8 and the stripe size is 128KB, then the maximum pre-fetch size is 8x128KB.

3.3.6.10

Command Name	Command Description
DriveCacheMode	Use this command to enable or disable drive cache(s).
Parameter 1	**Parameter Description**
Drive No.: <Drive=<1~n:All>>	Drive No.: Specify a drive or all drives to enable or disable cache. <1~n>, where n stands for maximum existing drive number. Drive=All, the command will have effect on all existing drives.
Parameter 2	
Switch setting: <Switch =<Enable:Disable>>	Switch setting: Enable or disable the cache(s) on the specified drive(s).

3.3.6.11

Command Name	Command Description
CtrlTime	Use this command to set controller time.
Parameter 1	**Parameter Description**
Year: <Year=<0~99>>	Year: Year=xx means year 20xx.
Parameter 2	
Month: <Month =<1~12>>	
Parameter 3	
Day: <Day =<1~31>>	
Parameter 5	
Hour: <Hour=<0~23>>	
Parameter 6	
Minute: <Min =<0~59>>	
Parameter 7	
Second: <Sec =<0~59>>	

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3.3.7 Firmware Update Commands

3.3.7.1

Command Name	Command Description
UpdateSystemCode	Update system code for the active controller. The controller needs to be restarted for the new system code to take effect.
Parameter 1	**Parameter Description**
File Path: <[DIR] <FileName>>	File Path: Specify an existing System Code image file(FileName) located in the specified directory.

3.3.7.2

Command Name	Command Description
UpdateBootCode	Update boot code for the active controller. The controller needs to be restarted for the new boot code to take effect.
Parameter 1	**Parameter Description**
File Path: <[DIR] <FileName>>	File Path: Specify an existing Boot Code image file(FileName) located in the specified directory.

3.3.7.3

Command Name	Command Description
UpdateBIOSEFI	Update BIOS and EFI firmware for the active controller. The controller needs to be restarted for the new BIOS/EFI to take effect.
Parameter 1	**Parameter Description**
File Path: <[DIR] <FileName>>	File Path: Specify an existing BIOS/EFI image file(FileName) located in the specified directory.

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Appendix I.

Array Migration Matrix:

Target RAID Level / Source RAID Level	R0	R1	R5	R0+1	R6
R0 (*N* Disks)		Can't Migrate	≧*N*+1	≧2*N*	≧N+2
R1 (*N* Disks)	≧2		≧3	≧4	≧5
R5 (*N* Disks)	≧*N*-1	Can't Migrate		≧2(*N* -1)	≧N/2+2
R0+1 (*N* Disks)	≧*N*/2	Can't Migrate	≧*N*/2+1		≧N+1
R6 (*N* Disks)	≧N-2	Can't Migrate	≧2(N-2)	≧N-1	

Note: Most RAID levels can be migrated to other levels. The migration may require additional disk(s) to be added. The data capacity of the new array is **equal** to or **larger** than the original array. The variable '*N*' represents the number of member disks in the "Source RAID" array.

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